B.E.(with Credits)-Regular-Semester 2012-Civil Engineering Sem III

CL302 - Strength of Material

P. Pages : 3 **GUG/W/16/3677**

Time : Three Hours * 3 5 9 7 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Answer **all** questions.
3. Due credit will be given neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.
6. Non programmable calculator is allowed.

1. a) A homogeneous bar ABCD shown in fig 1 is supported by a cable that runs from A to B around the smooth peg at E, a vertical cable at C, and a smooth inclined surface at D. Determine the mass of the heaviest bar that can be supported if the stress in each cable is limited to 100 MPa. The area of cable ACB is $250\,mm^2$ and that of cable at C is $300\,mm^2$. **10**

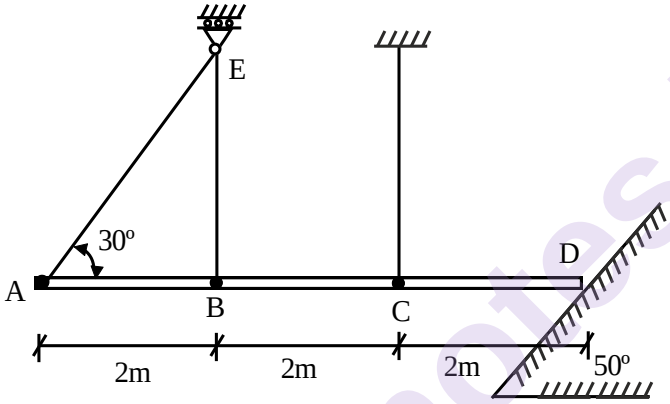

Fig 1

b) Derive the expression for loop stress of thin walled pressure vessels with neat sketch. **6**

OR

2. a) What is Necking ? Explain the method to determine yield strength using offset method of mild steel bar. **8**

b) A steel bar 50mm in diameter and 2m long is surrounded by a shell of cost iron 5mm thick. Compute the load that will compress the combined bar a total of 0.8 mm in length of 2m. For steel, E = 200 GPa, and for cost iron E = 100 GPa. **8**

3. Write the shear and moment equation for the cantilever beam carrying the uniformly varying load and concentrated load shown in Fig. 2. Also, sketch the shear and moment diagrams. **16**

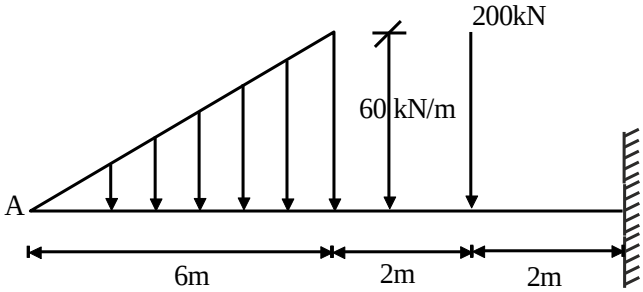

Fig 2 (Que 3)

OR

4. From the given shear force diagram as shown in fig (3), construct the load diagram and then plot bending moment diagram showing the point of contra flexure if any. **16**

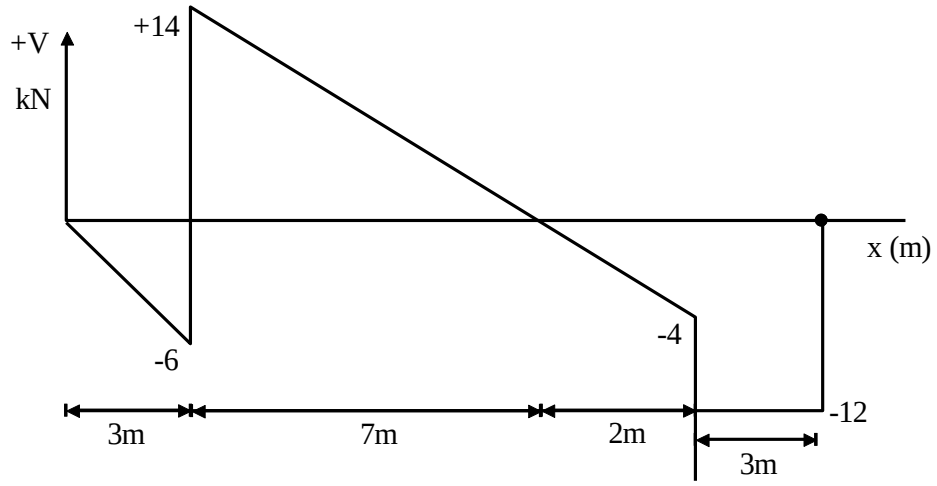

Fig 3: Shear Force Diagram

5. a) A simply supported beam 5cm wide by 10 cm high and 4m long, is subjected to a concentrated load of 5kN at a point 1m from left support. Determine the maximum fiber stress and the stress in a fiber located 1.25cm from the top of the beam at mid span. **8**

b) A 50mm diameter bar is used as a simply supported beam 3m long. Determine the largest uniformly distributed load that can be applied over the right two-thirds of the beam if the flexural stress is limited to 50 MPa. **8**

OR

6. Determine the maximum and minimum shearing stress in the web of wide-flange section shown in fig 4 if v = 100 kN. Also, compute the percentage of vertical shear carried only by the web of the beam. **16**

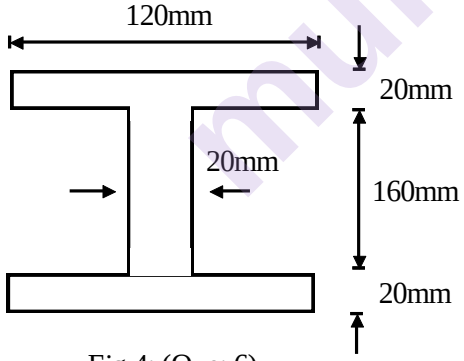

Fig 4: (Que: 6)

7. a) For the beam loaded as shown in fig (5) compute the value of slope and deflection at A, B, C and D in terms of E_I. **12**

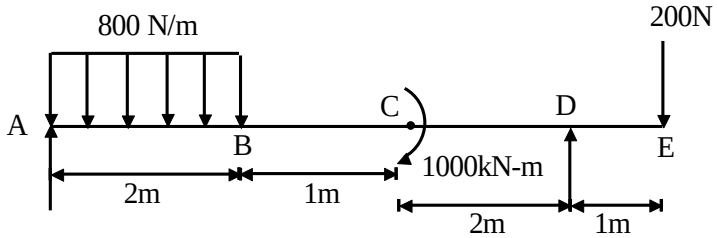

Fig 5 (Que No. 7 a)

b) Explain torsion theory for axisymmetric section. **4**

OR

8. a) Define torsional rigidity and torsional stiffness with it's formula. **4**

b) A shaft has to transmit a torque of 30 kN-m. The maximum shear stress is not to exceed 100MPa and the angle of twist is not to exceed 1°/meter length. G = 80 GPa. Design the shaft according to given specifications if it is a i) solid circular shaft and ii) hollow circular shaft of internal diameter 90% of the external diameter. **12**

9. Find the major and minor principal stresses and the planes on which they act for the plane stress system shown in fig 6. Show the stresses and planes on a neat sketch. Compare the result with graphical solution. **16**

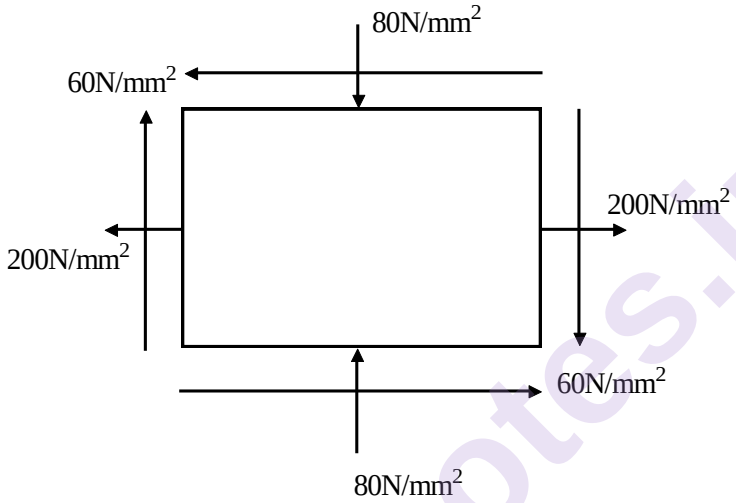

Fig 6

OR

10. a) Design a solid circular shaft subjected to a Bending moment of 20 kN-m and a torque of 12kN-m at a section. The maximum normal stress and shear stress are limited to 150 MPa and 120 MPa respectively. **12**

b) State the major difference in Mohr's circles for stress and strain. **4**

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